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For: INFORMATION STORAGE MEDIUM HAVING MULTI-ANGLE DATA STRUCTURES AND APPARATUS THEREFOR

SUBMISSION OF VERIFIED TRANSLATION OF U.S. PROVISIONAL APPLICATION NO. 60/452,550

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In accordance with the request by the applicant(s), enclosed herewith is a verified translated copy of the following U.S. Provisional application:

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It is respectfully requested that the applicant(s) be given the benefit of the filing date(s) as evidenced by the verified translated papers attached hereto.

Respectfully submitted,

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IN THE MATTER OF

U.S. Provisional Application No. 60/452,550

By Samsung Electronics Co., Ltd

I, Eun-sook Lee, an employee of Y.P.LEE, MOCK & PARTNERS of The Cheonghwa Bldg., 1571-18 Seocho-dong, Seocho-gu, Seoul, Republic of Korea, hereby declare that I am familiar with the Korean and English language and that I am the translator of U.S. Provisional Application and certify that the following is to the best of my knowledge and belief a true and correct translation.

Signed this 1st day of November 2003

Eunsook lee

INFORMATION STORAGE MEDIUM HAVING MULTI-ANGLE DATA STRUCTURES AND APPARATUS THEREFOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an information storage medium having multi-angle data structures and an apparatus therefor.

2. Description of the Related Art

Among conventional information storage media, DVDs are representative optical disks capable of storing multi-angle data. Multi-angle data is recorded on a DVD using an interleaving method in which data to be recorded is divided into predetermined units and recorded in turns. Information for seeking and reproducing interleaved blocks is recorded in motion picture bit-streams.

A data structure of a DVD used in a conventional multi-media reproduction apparatus is described below.

FIG. 1 shows a data structure used in the DVD.

Referring to FIG. 1, a DVD storage area includes a VMG area, wherein title information and title menu information are stored, and a plurality of VTS areas, wherein a plurality of movies are stored. Generally, the VMG area is composed of two or three files and each VTS area is composed of three through twelve files.

FIG. 2 shows a data structure of the VMG area.

Referring to FIG. 2, the VMG area includes a VMGI area storing additional information related to the VMG area, a VOBS area storing video objects for menu, and a backup area of VMGI. Each area exists as one file, and the VOBS area may be omitted in some cases.

In the VTS area, the information for title as a reproduction unit and VOBS as motion picture information are stored. A plurality of titles can be stored in one VTS.

FIG. 3 shows a data structure of the VTS area.

Referring to FIG. 3, the VTS area includes Video Title Set Information (VTSI), VOBS as motion picture data for menu picture, VOBS as motion picture information for video title set, and backup data of VTSI. VOBS for displaying a menu picture can be included selectively in the VTS area. Each VOBS is subdivided into VOBs

and cells as recording units. One VOB is composed of a plurality of cells. The smallest recording unit among the recording units according to the present invention is the cell.

In the DVD, each layer is a reproduction unit and a title is provided in a top layer. The title is connected with one or more PGCs. A PGC among the plurality of PGCs to be first reproduced is called Entry PGC. FIG. 4 shows a title composed of only one PGC, that is, Entry PGC. FIG. 5 shows a title composed of a plurality of PGCs. As shown in FIG. 5, if reproduction of one PGC is complete, another PGC among the plurality of PGCs can be selected and reproduced, and information for a reproduction sequence of PGC can be stored as a command in DVD. Control of such a reproduction sequence is called Navigation. The command of deciding a reproduction sequence is stored in PGCI.

FIG. 6 shows a data structure of the PGC.

Referring to FIG. 6, the PGC is stored as an information structure such as PGCI. The PGCI is composed of a pre-command storing a navigation command, a post-command, and a plurality of program information. The pre-command is a command performed before reproduction of a corresponding PGC, and the post-command is a command performed after reproduction of a corresponding PGC. Each program is composed of a plurality of cell information. These cells are connected on a one-to-one basis to Cells in VOB as recording units. Each cell has a cell command performed after reproduction of the cell is complete. The PGCI information describes PGC as a recording unit hierarchically. The PGCI information has an information structure for connecting a cell as a lowest reproduction unit to a cell as a lowest recording unit.

Particularly, in the PGC, the plurality of cells as the recording units are interconnected, and the plurality of cells form one angle block.

FIG. 7 shows an example of the angle block.

As shown in FIG. 7, the angle block is composed of a plurality of cells arranged in parallel. Upon reproduction, one cell in the angle block is selected and reproduced. The plurality of cells forming the angle block have a same reproduction time and each cell corresponds to an angle data in the angle block, angle data divided into interleaved units (ILVUs) as predetermined units are interleaved with each other and recorded to VOBs and Cells as recording units.

FIG. 8 shows the VOBs and cells as the recording units in case of not including multi-angle data.

Referring to FIG. 8, each VOB is stored and recorded as a contiguous recording space of the information storage medium. However, in the case of multi-angle data, as shown in FIG. 9, the VOBs, each of which corresponds to an angle data, and the Cells as the lower units thereof are recorded as an interleaved block, in which ILVU units are interleaved. Accordingly, one angle data is not stored within a contiguous recording area, and each angle data have to be interleaved and recorded in a predetermined order.

FIG. 9 shows an example in which two angle data are interleaved and recorded in order.

Referring to FIG. 9, each ILVU should have a same reproduction time. A size of recording length of data can be changed according to data compressibility. To reproduce interleaved data, jumping of the ILVU data unit is required in both cases where one angle data is reproduced and where angle data is changed and then reproduced. For example, to reproduce data corresponding to angle 1, it is required to seek and reproduce only ILVU data corresponding to the angle 1. If change into another data angle is required while the angle data is reproduced, jumping into a specific location corresponding to the changed angle should be performed. At this time, the jumping location is also decided based on the ILVU unit. Location information for an ILVU unit of a corresponding angle and for another ILVU unit of another angle connected to the corresponding angle is recorded in motion picture bit-streams. As shown in FIG. 10, VOBS as a motion picture bit-stream has a layered structure and a lowest layer is composed of PCKs (PACKs) such as NV_PCK, A_PCK, V_PCK, and SP_PCK. The NV_PCK called navigation pack, as shown in FIG. 11, stores location and size information SML_AGL_Cn_DSTA of ILVU data for maximum nine angles supported by DVD. These are information for seeking ILVU data for angle n connected to the ILVU data currently being reproduced. After reproduction of the present ILVU data is complete, angle change into a desired angle can be performed using this information to reproduce ILVU data for the desired angle. Such location information of ILVU data is multiplexed and recorded in the bit-streams of the interleaved and recorded motion picture data.

FIG. 12 is a view showing jumpings into selected angles, in a reproduction order.

Referring to FIG. 12, to perform a seamless change for reproducing motion pictures, when an angle change command from a user is received at a specific location, jumping into ILVU data of the desired angle is generated after reproduction of present ILUV data is complete and reproduction of the ILVU data of the desired angle is performed.

Now, an authoring process of DVD for multi-angle data is described below. First, images taken from various angles are compressed respectively and bit-streams having a same reproduction length are created. One bit-stream is interleaved and constructed and information capable of referring to different angles is inserted in the respective bit-streams, which allows angle change in the midst of reproduction.

Since information related to interleaving is multiplexed and recorded in the motion picture data stream, this information should be extracted. Generally, to seek and reproduce an interleaved block belonging to a same angle, or to change into another interleaved block belonging to another angle and seek and reproduce the changed interleaved block is processed through software by the CPU of the reproduction apparatus. This software accesses the interleaved block currently being reproduced, obtains location information for a desired interleaved block to be reproduced, and transfers the obtained location information to a data reading device. Also, compressed and encoded motion picture data is processed in a motion picture demultiplexer. Accordingly, a process for extracting location information from motion picture data and transferring the location information to the CPU is needed.

Furthermore, in the case that multi-angle data is divided into predetermined units, interleaved, and stored, reproduction location change is continuously required in order to read data successively, because the corresponding data is not recorded successively even in the case one angle data is reproduced successively. Also, a problem exists in that in the case where a considerable time for location change is needed like optical disks or hard disks, bit-rate of compressed bit-streams is limited in order to compensate this time.

SUMMARY OF THE INVENTION

The present invention provides an information storage medium having a data structure capable of removing storage location limitation of multi-angle data and allowing random access of the multi-angle data, and an apparatus therefor.

The present invention further provides an information storage medium, which records information for jumping-points required for successive reproduction and angle change of multi-angle data, on a separate storage area from the motion picture data, and an apparatus therefor.

The present invention further more provides an information storage medium, which records information for jump-points required for successive reproduction and angle change of multi-angle data integrated with information for random access supported by motion picture data, and an apparatus therefor.

According to an aspect of the present invention, there is provided an information storage medium, in which a plurality of motion picture data for multi-angle are stored in clips as recording units, each clip including additional information for clip in a separate storage area from the motion picture data, and the additional information including information for a plurality of jumping-points through which the data for multi-angle are reproduced successively and angle changes are performed, wherein the additional information is integrated and recorded with information for random access supported by the motion picture data, and each clip for each angle is interleaved and recorded to each other, or at least one clip for a desired angle is divided and recorded in a contiguous recording area of the information storage medium.

The motion picture data for each angle has a plurality of jumping-points as access points through which another angles are connectedly and successively reproduced, and further includes additional information for jumping-points.

It is preferred that the motion picture data contains clip information as additional information for clips, wherein the clip information contains the additional information for jumping-points.

It is preferred that the information for jumping-points is location information from a start location of the clip to each jumping-point, which is stored in a table format.

It is preferred that the clip information includes, as entry point information, information related to points allowing random access, and the information for jumping-points is added to the entry point information, indicating whether a corresponding entry point acts as a jumping-point.

It is preferred that the information for jumping-points is recorded duplicately and individually on the respective clips, the duplicate jumping-point information is

stored as a table on which location information for each jumping-point of each clip is recorded in order, and the clip information refers to the jumping-point information.

It is preferred that locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is performed when reproduction location change is performed in order to reproduce another clip for another angle in the midst of reproducing a clip for one specific angle.

It is preferred that PlayList information composed of a plurality of PlayItems, each of which corresponds to each clip, is recorded additionally as reproduction unit information, and information for a plurality of angles contains information indicating whether the plurality of PlayItems form an angle block.

It is preferred that the PlayList information composed of a plurality of PlayItems, each of which corresponds to each clip, is recorded additionally as reproduction unit information, wherein one PlayList corresponds to one angle.

It is preferred that additional information indicating specific angles is recorded additionally to the PlayList each which corresponds to each angle.

According to another aspect of the present invention, there is provided a reproduction apparatus, which reproduces information from an information storage medium in which a plurality of motion picture data are divided and recorded on clips as recording units, each clip including additional information for clip in a separate storage area, the additional information containing information for jumping-points required for successive reproduction and angle change of multi-angle data in a separate storage area from the motion picture data, and particularly, the information for jumping-points is integrated and recorded with information for random access supported by the motion picture data, and each clip for each angle is interleaved to each other and recorded on a separate recording area, or divided or recorded in a contiguous recording area, wherein the reproduction apparatus reads and reproduces data for a corresponding angle.

The motion picture data for each angle includes a plurality of jumping-points as access points through which another angles are connectedly and successively reproduced, and further contains additional information for jumping-points. When reproduction of multi-angle motion picture data is performed, a corresponding clip is sought, data belonging to a corresponding angle is read and reproduced. If reproduction location change occurs in the midst of reproduction of one clip, jumping from a current jumping-point into a corresponding jumping-point of a clip of different

angle data is generated and reproduction is performed from the corresponding jumping-point, wherein both jumping-points are location information in both clips at a same reproduction time-point.

It is preferred that each motion picture data further includes clip information that is the additional information for clips as the recording units, the clip information includes the information for jumping-points, and the reproduction unit searches for the information for jumping-points in the clip information.

It is preferred that the information for jumping-points is location information from a start location of the clip to each jumping-point, which is stored as a table in the clip information, and the reproduction unit presumes, that jumping-points at which information recording locations of clips constituting multi-angles are identical to each other in the table, are interconnected, and seeks and reproduces locations of the interconnected jumping-points, when reproduction location change into another angle is performed.

It is performed that the clip information includes entry point information for points allowing random access, and the information for jumping-points is added to the entry point information and stored as information indicating whether a corresponding entry point acts as a jumping-point, and the reproduction unit presumes, that jumping points having the same recording location as that of the entry points acting as the jumping-points in the entry point information of the clips constituting the multi-angles, are interconnected, and seeks and reproduces the locations of the interconnected jumping-points when reproduction location change into another angle occurs.

It is preferred that the information for jumping-points is recorded duplicatedly and individually on the clips, the jumping-point information is stored as a table on which location information for each jumping-point are recorded in order, and the reproduction apparatus reads the jumping-point information of clips constituting the multi-angles, and seeks and reproduces the locations of interconnected jumping-points when reproduction location change into another angle is performed.

It is preferred that locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is performed when reproduction location change is performed in order to reproduce another clip for another angle in the midst of reproducing a clip for one specific angle, and the reproduction unit begins to reproduce from a jumping-point connected to a next

angle after terminating reproduction up to a nearest jumping-point to a currently reproduction location, if a signal requesting a change of angle is received from a user, in order to achieve successive reproduction.

It is preferred that the information storage medium stores PlayList information composed of a plurality of PlayItems each which corresponds to each clip as reproduction unit information, wherein the PlayItem designates all or some of the clips, and information indicating whether the plurality of PlayItems form an angle block is recorded as information for a plurality of angles, and the reproduction apparatus reproduces one PlayItem among the plurality of PlayItems and reproduces another corresponding PlayItem when production location change into another angle is performed.

It is preferred that the information storage medium stores PlayItem information composed of a plurality of PlayItems each which corresponds to each clip, as reproduction unit information, the PlayItem designates all or some of the clips, one PlayList corresponds to one angle, and the reproduction apparatus reproduces a PlayList corresponding to each angle.

It is preferred that the PlayList stores information related to each corresponding angle of each PlayList, and the reproduction apparatus reproduces a PlayList corresponding to each angle.

According to still another aspect of the present invention, there is provided a recording apparatus for recording motion picture data for multi-angle in an information storage medium having random access function, wherein a plurality of motion picture data for respective angles are divided and recorded on clips as recording units, each clip includes additional information for clip in a separate storage area, the additional information contains information for jumping-points required for successive reproduction and angle change of multi-angle data, in a separate storage area from the motion picture data, particularly, the additional information is integrated and recorded with information for random access supported by the motion picture data, each clip for each angle is interleaved to each other and recorded on a recording area, or divided and recorded in a contiguous recording area of the information storage medium.

It is preferred that a plurality of jumping-points are created as access points through which another angles are connectedly and successively reproduced,

additionally to the motion picture data for respective angles, and additional information for jumping-points is recorded on the information storage medium.

It is preferred that clip information which is additional information for clip is added as the recorded unit, additionally to each motion picture data, and the clip information includes the information for jumping-points to be recorded on the information storage medium.

It is preferred that the information for jumping-points is location information from a start location of the clip to each jumping-point, and the information for jumping-points is included as a table in the clip information to be recorded on the information storage medium.

It is preferred that the recording apparatus records as the clip information, entry point information related to points allowing random access, and the jumping-point information is added to the entry point information and stored as information indicating whether a corresponding entry point acts as a jumping-point.

It is preferred that the recording apparatus records the information for jumping-points duplicatedly and individually on the clips, and stores the jumping-point information as a table on which location information for each jumping-point is recorded in order.

It is preferred that locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is achieved, when seeking and reproducing data for one angle, or changing reproduction location into another angle and reproducing another angle in the midst of reproducing a clip for a specific angle.

It is preferred that the recording apparatus records as reproduction unit information, PlayList information composed of a plurality of PlayItems each which corresponds to each clip as reproduction unit information, and records the information for multi-angle as information indicating whether the plurality of PlayItems form an angle block.

It is preferred that the recording apparatus adds and records as reproduction unit information, PlayList information composed of a plurality of PlayItems each which corresponds to each clip, wherein one PlayList corresponds to one angle.

It is preferred that the recording apparatus adds and records, as information for multi-angle, additional information indicating a specific angle, to the PlayLists each which corresponds to each angel.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

FIG. 1 shows a data structure of a DVD;

FIG. 2 shows a data structure of a VMG area of FIG. 1;

FIG. 3 shows a data structure of a VTS area of FIG. 1;

FIG. 4 shows a title composed of one PGC, Entry PGC;

FIG. 5 shows a title composed of a plurality of PGCs;

FIG. 6 shows a data structure of the PGC;

FIG. 7 shows a construction of an angle block;

FIG. 8 shows VOBs and Cells as recording units in case of not including multi-angle data;

FIG. 9 shows an example in which two angle data are interleaved and recorded in order;

FIG. 10 shows a detailed layer of a motion picture bit-stream;

FIG. 11 shows an information structure for reproducing multi-angle recorded on NV_PCK;

FIG. 12 is a view showing jumpings into selected angles, in reproduction order;

FIG. 13 shows location relationship among jumping-units, jumping-points, and Entry-Points;

FIG. 14 is a view for describing a method in which respective clips are recorded in a contiguous storage area;

FIG. 15 is a view for describing a method in which respective clips are interleaved and recorded;

FIG. 16 is a view for describing a correlation among PlayLists, PlayItems, Clip information, and Clips;

FIG. 17 is a view for describing a relationship between jumping operations and buffers, for successively reproducing motion picture data;

FIG. 18 shows an exemplary construction of a PlayList having a multi-angle structure, according to the present invention;

FIG. 19 is a first embodiment of a data structure for jumping-points;

FIG. 20 is a second embodiment of a data structure for jumping-points;

FIG. 21 is a third embodiment of a data structure for jumping-points;

FIG. 22 is an example of PlayList information having PlayItems constituting an angle block;

FIG. 23 shows an exemplary construction of PlayLists as reproduction units according to respective angles; and

FIG. 24 shows an exemplary structure of additional information for an angle represented by a corresponding PlayList.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, embodiments of the present invention will be described in detail with reference to the appended drawings.

The present invention provides a medium in which multi-angle motion picture data and information for jumping-points for reproducing each angle data are recorded in a separate storage area, wherein, motion picture data for one angle is stored into clips as recording units, and clips are individually divided into smaller interleaved blocks and interleaved with each other. Alternately, each angle data is recorded in the predetermined storage area using a division recording method. Jumping-point information for seeking respective angles is stored in a separate storage area from the motion picture data constituting the respective angles. To change one angle into another angle, respective angle data are classified into respective jumping-units (JPUs), a start address of each jumping-unit is designated as a jumping point, and then the jumping point is recorded as separate additional information. In the case where one angle data is divided into interleaved blocks and interleaved with another angle data, the interleaved blocks act as the jumping-units.

To perform the operation described above, the present invention comprises the following components.

(1) compressed and encoded audio-visual (AV) streams (clips) for respective angles;

(2) clip information file having information such as encoding attribute information for AV stream;

(3) PlayItem for setting time on the basis of a reproduction interval between IN-time and OUT-time of a clip;

(4) PlayList composed of one or more PlayItem; and

(5) jumping-point map which stores locations of jumping-points.

Multi-angle data represents motion picture data having a plurality of reproduction units at a specific time-point. That is, the multi-angle data is motion picture data that are photographed simultaneously using a plurality of cameras at a specific time-point. Audio data is generally common for each angle, but may be created differently for each angle. Motion picture data capable of being reproduced at a same time-band are called multi-angle data and contents created using the multi-angle data are called multi-angle contents.

Since the motion picture data is very large in size, the motion picture data is compressed and stored/transmitted as compressed bit-streams. In the present invention, terms such as Clip as a recoding unit, and PlayList and PlayItem as reproduction units, are used. The clip corresponds to a cell as a recoding unit of DVD, and the PlayList and PlayItem correspond to a program and cell as reproduction units of DVD.

An information recording medium according to the present invention stores AV streams as clips. Generally, a clip is divided into interleaved blocks to be interleaved, or recorded individually in a contiguous storage area. Each AV stream is compressed and recorded to reduce its size. To reproduce the recorded clips, characteristic information of the compressed motion picture data is needed. For this reason, clip information must be recorded on each clip. The clip information includes audio and video attributes for each clip, an Entry Point Map that stores location information of entry-points allowing random access per predetermined intervals, etc. In MPEG that is utilized generally as motion picture compression standards, the entry-points correspond to the locations of I-pictures to which intra-images are compressed. The Entry Point Map is mainly utilized in time-seeking for seeking a predetermined time-elapsed point after reproduction starts.

FIG. 13 shows location relationship among jumping-units, jumping-points, and Entry-Points on a clip AV stream. As seen in FIG. 13, if one clip is motion picture data corresponding to one angle data among multi-angle data, the clip is divided into a plurality of jumping-units. Each start-point of each jumping-unit is a jumping-point. The jumping-point is a location which is jumped-out to another clip corresponding to motion picture data having a different angle in the midst of reproducing a corresponding clip, or jumped-in to the corresponding clip in the midst of reproducing

the another clip. The jumping-point is preferably identical to Entry-Point. However, since Entry-Points exist per about 0.5 second time-intervals, using all Entry-Points as jumping-points is not preferred in seamless reproduction. As shown in FIG. 13, one jumping-unit may include a plurality of Entry-Points. A jumping-point preferably indicates a first Entry-Point among the plurality of Entry-Points within the jumping-unit.

Hereinafter, an example of data structure and recording locations of multi-angle data will be described.

FIG. 14 shows a situation that a plurality of clips for multi-angle data are not interleaved and the respective clips are recorded individually in a contiguous recording area.

Referring to FIG. 14, a plurality of clips have a same number of jumping-points, respectively, and are interconnected virtually. The respective clips are divided and recorded individually in a continuous storage area, but connected to each other at jumping-points as locations indicating a same reproduction time-point. Accordingly, in the case of reproducing another clip in the midst of reproducing a corresponding clip, successive reproduction can be performed by seeking and reproducing the jumping-point of the next jumping-unit of the another clip after terminating reproduction of the jumping-unit of the corresponding clip being currently reproduced. FIG. 14 shows a reproduction sequence where, first, angle 3 is reproduced, then angle 1 is reproduced, and successively angle m is reproduced. A user input for an angle change is processed on the basis of jumping-units.

FIG. 15 is a view for describing a method in which respective clips are interleaved and recorded.

As shown in FIG. 15, if a clip as one angle data is divided into smaller interleaved units to be interleaved with different angle data, a jumping-unit acts as an interleaved unit, and a start-point of the interleaved unit acts as a jumping-point and simultaneously as a first Entry-Point of the corresponding interleaved unit. One interleaved unit may include a plurality of Entry-Points. In this case, there can be a jumping at a certain jumping-point even in the midst of reproducing one angle. That is, it is needed to seek and reproduce an interleaved unit belonging to a corresponding angle. To reproduce a next interleaved unit belonging to a same angle after reproduction of an interleaved unit is complete, the location of the next interleaved unit must be found. At this time, jumping-point information is used.

Also, when angle location change into another angle is performed, the jumping point information is used for searching for the location of a corresponding interleaved unit of another angle.

FIG. 16 shows the correlation among PlayList, PlayItem, Clip Information, and Clip.

Referring to FIG. 16, PlayList is a basic unit for reproduction. The information storage medium according to the present invention stores a plurality of PlayLists. One PlayList consists of a plurality of PlayItems interconnected. The PlayItem is certain part of a clip and is used for designating a reproduction start time and reproduction end time of the clip. The location of the corresponding part (PlayItem) in an actual clip can be found using the clip information.

The information storage medium according to the present invention, capable of allowing random access, can perform successive reproduction by changing reproduction locations in a predetermined time, even in a non-contiguous storage area. This location change is called "jumping" in the present invention. Generally, an electronic information storage medium such as memory does not require a predetermined jumping time, but an information storage medium such as an optical disk that moves pick-up and reads data, requires a considerable time for jumping operation. Also, in the case that a reading speed of motion picture data from the information storage medium is different from a reproduction speed of the read motion picture data, a component for compensating the difference between the reading speed and the reproduction speed is needed even in a case of reading and reproducing a contiguous storage area. As such a component, a motion picture buffer is used. A motion picture buffer having a predetermined size is prepared, the buffer is fulfilled through reading data at a predetermined speed, and then reproduction is performed. Also, the reading speed of data is controlled so as to prevent overflow or underflow of the motion picture buffer. By using the motion picture buffer, even when the motion picture data is recorded at a variable bit-rate (VBR), successive reproduction is possible.

As shown in FIG. 17, data stored in the motion picture buffer is reproduced in such a manner that, even when one jumping-unit is reproduced and then a jumping is generated to a clip storing motion picture data for another angle, the motion picture data is reproduced without disconnection during the jumping operation time. Before the underflow of the buffer is occurred, the jumping operation must be

complete and a jumping unit of a next angle must be started. In the case of the reproduction device requiring a jumping operation time, if it is assumed that a worst jump operation time is T_JUMP, a data reading speed is V_R, and a reproduction speed of motion picture data is V_0, the size of the jump unit must satisfy the following condition.

Jumping unit size > V_R * V_O * T_JUMP/(V_R - V_O)

Also, the buffer must satisfy the following size condition.

Buffer size (B) > V_O * T_JUMP

FIG. 18 shows an exemplary construction of a PlayList having a multi-angle structure, according to the present invention.

Referring to FIG. 18. PlayItems constituting one PlayList generally have a sequential structure, but a plurality of PlayItems, as denoted by the second PlayItem in FIG. 18, can form one angle block in case of the PlayList having multi-angle. Upon reproduction, one of PlayItem belonging to this angle block can be reproduced. A PlayItem to be reproduced, among respective PlayItems belonging to the angle block, is changeable by angle change during reproduction. The PlayItems forming an angle block generally have a same reproduction time. According to the present invention, clips designated to the PlayItems forming the angle block include jumping-points information as additional information in a separate storage area from motion picture data. The clips being motion picture data are interleaved to each other, or divided and recorded in a contiguous storage area without being interleaved. When being interleaved, each clip is divided into smaller units, that is, interleaved units, to be interleaved with each other with clips for another angles. In case of being not interleaved, the Clip 2, Clip 3, and Clip 4 are recorded respectively on the contiguous storage area. Accordingly, these clips are the same as clips that do not form the angle block.

As data structures for providing the jumping-points, three preferred embodiments are as follows.

FIG. 19 shows a first embodiment of a data structure for providing jumping-points.

Referring to FIG. 19, in the case that a corresponding clip is a clip for angle, Jumping point Map information is created and included in the clip information, additionally to a conventional General Information and Entry Point Map. Since the jumping point information should be recorded on a separate storage area from the

motion picture data and also has a close relation with the motion picture data, the jumping point information is preferably included in clip information data that is additional information for the clip as the recording unit. The General Information includes as main information, information as follows.

- version_number: version of clip information file
- EPMap_start_address: relative byte number from a first byte of the clip information file, indicating a start address of Entry Point Map
- JPMap_start_address: relative byte number from a first byte of the clip information file, indicating a start address of Jumping point Map, wherein if this value is zero, the corresponding clip is not a clip for angle and Jumping point Map information does not exist.
- ClipInfo: storing attributes of an AV stream file related to the clip information file

The Entry Point Map includes information for the time and location of Entry Point capable of random access. Generally, the reproduction time is Presentation Time defined in MPEG and the location information is the number of bytes or the number of sectors in this preferred embodiment, or the number of MPEG-TS packets in the case that the motion picture information is encoded in MPEG Transport Streams. The Jumping point Map includes information for jumping point, in order to virtually connect with clips of other angles in the case that the corresponding clip is a clip for angle. In this preferred embodiment, the Jump Manager Information of the Jumping point Map stores the number of jumping-points and successively stores the corresponding jumping point information. The Jumping point Information includes information for seeking the location of the corresponding jumping point from the start location of the corresponding clip. According to this preferred embodiment, this location information is the number of bytes or the number of sectors. Alternately, the location information may be the number of MPEG-TS packets if the information is encoded in MPEG Transport Streams.

FIG. 20 shows a second embodiment of a data structure for providing jumping-points.

Referring to FIG. 20, the jumping point information is inserted into conventional EP Map information. As described above, the jumping point is preferably identical to the Entry Point as a random access point in the case that a moving picture is encoded by performing space-time compression such as the

MPEG. Accordingly, the information for jumping points can be easily recorded by inserting information about whether a corresponding Entry Point acts as a jumping point to the information for Entry Point.

FIG. 21 shows a third embodiment of a data structure for providing jumping points.

Referring to FIG. 21, an additional information structure is created by collecting jumping-point information for clips forming an angle block. That is, the number of the clips forming one angle block and the number of the jumping-points existing in one clip are stored in the Jump Manager Information and then information for the jumping-points for each clip is stored sequentially in the Jump Manager Information. This information structure has an advantage that a corresponding location of each angle can be easily searched for.

FIG. 22 shows an example of PlayList information including PlayItems constituting an angle block.

Referring to FIG. 22, the PlayItem information includes angle block information in addition to general PlayItem information. This angle block information basically includes information about whether the corresponding PlayItem constitutes the angle block. The PlayItem information constituting the angle block should be recorded in order. Upon reproduction, one among a plurality of PlayItems constituting an angle block, among the PlayItems forming a PlayList, is reproduced basically. While the PlayItem is reproduced, the PlayItem can be changed and reproduced into another PlayItem belonging to the same angle block.

FIG. 23 shows an exemplary construction of PlayLists as recording units according to respective angles.

Referring to FIG. 23, when one PlayList corresponds to one angle, the PlayItem belonging to the PlayList does not form an angle block. As shown in FIG. 23, information for an angle represented by a corresponding PlayList is recorded separately, and a corresponding PlayList according to an angle selection or angle change by a user is reproduced.

As described above, according to the present invention, the recording unit of the motion picture data forming multi-angle is interleaved with the information storage medium, or divided and recorded in a contiguous storage area. The connection locations of motion picture data representing respective angles are jumping-points, the jumping-points are managed as additional data in a separate

storage area from the motion picture data, and reproduction unit information for connecting and reproducing the corresponding recording units is provided additionally to the information for multi-angle. The reproduction apparatus performs the following operation in order to reproduce the data for multi-angle.

Since the information for jumping points for seeking and reproducing the angle data is recorded on a separate storage area from the motion picture data, before a corresponding motion picture is reproduced, the information for the jumping points is read from the information storage medium and stored in the memory. Then, the corresponding angle data is tracked and reproduced or another corresponding angle data according to an angle change by a user is tracked and reproduced. The clip being a recording unit includes connection information to motion picture data for another angle forming an angle block as jumping point information. Therefore, in the case that an angle change is required at a specific time-point, after reproduction is performed up to a next jumping point of the data being reproduced, motion picture information after a corresponding jumping point of motion picture data to be changed begins to be reproduced.

Also, in the case that the respective angles are not interleaved and recorded in a contiguous storage space, if an angle change is not performed although the data is multi-angle motion picture data, the data can be read and reproduced in the contiguous storage area. Therefore, the data can be encoded like general motion picture data without multi-angle. Accordingly, separate data or encoding limitation for successively reproducing an angle, as in interleaving, is not required.

In the case that information representing multi-angle as a information structure of a reproduction unit is recorded in a manner that a plurality of PlayItems belonging to a PlayList constitute an angle block (FIG. 21), when an angle change is required while one PlayItem belonging to the angle block is reproduced, after reproduction is complete up to the nearest jump-point to the current location of the clip for the angle being reproduced, a jumping-point after a corresponding jumping-point of another clip for another angle to be changed, begins to be reproduced. As shown in FIG. 23, in the case that separate PlayLists for respective angles are recorded, when an angle change is generated while a corresponding PlayList is reproduced, a changed PlayList is reproduced.

The recording apparatus according to the present invention is an apparatus for recoding the clip data, the jumping point information, and the reproduction unit

information, described above, in the information storage medium. A preferred embodiment of a recording method using the recording apparatus is as follows.

First, a size of a jumping unit is determined, considering of a reading speed V_R, a jumping time T_JUMP of the reproduction apparatus, and a maximum bit-rate V_O of moving picture data. The equation used for the determination is described above. The determined jumping unit size is converted into a reproduction time. Then, respective motion pictures are encoded so that random access points are created into units each that is equal to or more than this reproduction time. Boundary locations of these units are used as jumping-points. Generally, in the space-time compression method such as the MPEG, the random access point is a start point of a GOP (Group Of Picture), and accordingly the jumping unit is composed of a plurality of GOPs. The jumping point should be made at a same reproduction time for each motion picture.

The encoded motion picture data is interleaved by using the jumping unit as an interleaved unit, or recorded in a contiguous storage area of the information storage medium according to each angle thereof. The determined location information for the jumping-points is recorded as additional information. In the preferred embodiment, information for the corresponding jumping points according to respective clips can be recorded in the clip information.

Next, information for reproduction units forming multi-angle is created and recorded. At this time, a plurality of PlayItems each which corresponds to each clip, are created to constitute an angle block. These angle blocks are interconnected to create a PlayList. Alternately, an independent PlayList for each angle is created respectively.

As described above, according to the present invention, jumping point data representing multi-angle is recorded in a separate storage area from the motion picture data. The motion picture data is interleaved, or divided and recorded in a contiguous storage area without being not interleaved, thereby allowing effective distribution of recording area and random access. This also enables more efficient reading of multi-angle motion picture data.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein

without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. An information storage medium for storing multi-angle motion picture data thereon, the information storage medium comprising:

at least one clip which acts as a recoding unit for storing motion picture data for each angle,

wherein the motion picture data for each angle has a plurality of jumping-points as access points through which another angles are connectedly and successively reproduced, and additional information for the jumping-points is recorded in a separate storage area from the motion picture data.

2. The medium of claim 1, wherein each clip is recorded, in a contiguous storage area of the information storage medium.

3. The medium of claim 1, wherein each clip is interleaved with one another with jumping-points and recorded on the information storage medium.

4. The medium of claim 1, wherein each clip includes clip information that contains information for the jumping-points.

5. The medium of claim 4, wherein the information for the jumping-points is location information from a start location of the clip to each jumping-point, which is stored in a table format.

6. The medium of claim 4, wherein the clip information includes, as entry point information, information related to points allowing random access, and the information for jumping-points is added to the entry point information, indicating whether a corresponding entry point acts as a jumping-point.

7. The medium of any one of claims 1 through 3, wherein the information for jumping-points is recorded duplicately and individually on the respective clips, the duplicate jumping-point information is stored as a table on which location information for each jumping-point of each clip is recorded in order, and the clip information refers to the jumping-point information.

8. The medium of any one of claims 1 through 7, wherein locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is performed when reproduction location change is performed in order to reproduce another clip for another angle in the midst of reproducing a clip for one specific angle.

9. The medium of claim 8, wherein PlayList information composed of a plurality of PlayItems each which corresponds to each clip, is added as reproduction unit information, wherein one PlayList corresponds to one angle.

10. The medium of claim 8, wherein PlayList information composed of a plurality of PlayItems each of which corresponds to each clip, is added as reproduction unit information, wherein one PlayList corresponds to one angle.

11. The medium of claim 10, wherein the information indicating a specific angle is added to the PlayList each which corresponds to each angle.

12. An apparatus for reproducing information from an information storage medium, the information storage medium in which a plurality of motion picture data are divided and recorded into clips as recording units, each clip including a plurality of jumping-points through which another angles are connectedly and successively reproduced, and information for the jumping-points being recorded on a separate storage area from the clips, the apparatus comprising:

a reading unit which reads data from the information storage medium; and

a reproduction unit which reproduces data read by the reading unit, which if the read data is multi-angle motion picture data, seeks, reads, and reproduces a clip corresponding to the motion picture data, and if reproduction location change into another angle is required, begins to reproduce a clip corresponding to motion picture data for another angle at a corresponding jumping-point of the clip from a current jumping-point,

wherein both jumping-points are location information of both clips at a same reproduction time-point.

13. The apparatus of claim 12, wherein the clips are divided and recorded in a contiguous storage area, each clip includes motion picture data information corresponding to one angle if the corresponding motion picture data is data for multi-angle, and if the read data is motion picture data for multi-angle, the reproduction unit seeks, reads, and reproduces a clip corresponding to the motion picture data in a contiguous storage area.

14. The apparatus of claim 12, wherein the plurality of motion picture data are divided into clips as recording units and recorded on the information storage medium, the clip is divided and recorded in a contiguous storage area, the clips include motion picture data information corresponding to one angel data if the corresponding motion picture data is data for multi-angle, and if the read data is motion picture data for multi-angle, the reproduction unit seeks, reads, and reproduces a clip corresponding to the motion picture data.

15. The apparatus of claim 14, wherein each clip is interleaved between the jumping-points with a data clip for another angle, and recorded on the information storage medium, and

the reproduction unit seeks a clip corresponding to the motion picture data if the read data is the motion picture data for multi-angle, tracks an interleaved unit belonging to the corresponding angle, and reads and reproduces corresponding data.

16. The apparatus of any one of claims 12 through 15, wherein each motion picture data further includes clip information as additional information for the clips as the recording units, and the clip information includes the information for the jumping-points, and

the reproduction unit seeks the information for the jumping-points in the clip information.

17. The apparatus of claim 16, wherein the information for the jumping-points is location information from a start location of the clip to each jumping-point, which is stored as a table in the clip information; and

the reproduction unit assumes that jumping-points whose information recording locations are identical to each other in the table of the clips constituting the multi-angles are interconnected, and seeks and reproduces locations of the jumping-points connected to each other when reproduction location change into another angle is performed.

18. The apparatus of claim 16, wherein the clip information includes entry point information for points allowing random access, and the information for the jumping-points is added to the entry point information and stored as information indicating whether a corresponding entry point acts as a jumping-point, an

the reproduction unit assumes that jumping points, which have same recording location with a recording location of entry point information acting as the jumping-point in the entry point information of the clips constituting the multi-angles, are interconnected, and seeks and reproduces locations of the interconnected jumping-points when reproduction location change into another angle is performed.

19. The apparatus of any one of claims 12 through 15, wherein

the information storage medium duplicatedly records the information for jumping-points on clips of the plurality of angle data, the duplicate jumping-point information is stored as a table on which location information for each jumping-point of each clip is recorded in order, and

the reproduction unit reads the duplicate jumping-point information of clips forming the multi-angles, and seeks and reproduces locations of the interconnected jumping points when reproduction location change into another angle is performed.

20. The apparatus of any one of claims 12 through 15, wherein locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is performed when reproduction location change into another angle is performed in the midst of reproducing a clip of one angle, and

the reproduction unit begins to reproduce from a jumping-point connected to a next angle after completely reproducing up to a nearest jumping-point from a currently reproducing location, if a signal requesting a change of angle is received from a user, in order to achieve successive reproduction.

21. The apparatus of any one of claims 12 through 15, wherein the information storage medium stores PlayList information composed of a plurality of PlayItems, each of which corresponding to each clip as reproduction unit information, the PlayItem designating all or some of the clips and including as information for a plurality of angles information about whether the plurality of PlayItems constitute an angle block; and

the reproduction unit reproduces one among the plurality of PlayItems, and reproduces another corresponding PlayItem when angle change into another angle is performed.

22. The apparatus of claims 12 through 15, wherein the information storage medium stores the PlayList information composed of the plurality of PlayItems corresponding to each clip as the reproduction unit information, the PlayItem designating all or some of the clips, one PlayList corresponding to one angle, and

the reproduction unit reproduces a PlayList corresponding to the corresponding angle.

23. The apparatus of claim 22, wherein the PlayList stores information related to each corresponding angle of each PlayList, and the reproduction unit reproduces a PlayList corresponding to one angle.

24. A recording apparatus for recording multi-angle motion picture data on an information storage medium supporting a random access function, the recording apparatus comprising:

a recording unit which records data on the information storage medium; and

a controller that controls the recording apparatus to record clips as recording units of motion picture data corresponding to each angle, makes a plurality of jumping-points for connectedly and successively reproducing into another angle, additionally to motion picture data for each angle, and records information for the jumping-points as additional information on a separate storage space from the clips.

25. The apparatus of claim 23, wherein the controller controls the recording unit to record the clips in a contiguous storage area of the information storage

medium, and divide and record the motion picture data for each angle on the information storage medium without interleaving.

26. The apparatus of claim 23, wherein each clip is interleaved between the jumping-points with a data clip for another angle, and recorded on the information storage medium.

27. The apparatus of claims 23 through 26, wherein clip information is created as additional information for the clip additionally to each motion picture data, and the clip information includes the information for the jumping-points to be recorded on the information storage medium.

28. The apparatus of claim 27, wherein the information for the jumping-points is location information from a start location of the clip to each jumping-point, and is included as a table in the clip information.

29. The apparatus of claim 27, wherein the clip information includes as entry point information, information for points allowing random access, and the information for the jumping-points are added to the entry point information, and stored as information indicating whether a corresponding entry point acts as a jumping-point.

30. The apparatus of any one of claims 23 through 26, wherein the information for the jumping-points is recorded duplicatedly and individually on the clips of the multi-angle data, and the duplicate jumping-point information is stored as a table on which location information for respective jumping-point are recorded in order.

31. The apparatus of any one of claims 23 through 26, wherein locations of the jumping-points and intervals between the jumping-points are decided so that successive reproduction is performed when reproduction location change is performed in order to reproduce another clip for another angle in the midst of reproducing a clip for one specific angle.

32. The apparatus of any one of claims 23 through 26, wherein the PlayList information composed of a plurality of PlayItems, each of which corresponds to each clip, is added as reproduction unit information, and information for the plurality of angles is recorded as information indicating whether the plurality of PlayItems form one angle block.

33. The apparatus of any one of claims 23 and 26, wherein the PlayList information composed of the plurality of PlayItems, each of which corresponds to each clip, is recorded as reproduction unit information, and one PlayList corresponds to one angle.

34. The apparatus of claim 33, wherein the PlayList corresponding to each angle includes additional information indicating a specific angle as information for a plurality of angles.

Abstract of the Disclosure

An information storage medium for storing data structures supporting multi-angles is provided. The information storage medium includes clips as recording units of motion picture data for respective angles. As additional information for each clip, clip information is recorded on a separate storage area from the clip. The clip information includes jumping-point information for jumping into another angle. At least one clip for a desired angle can be divided and recorded in contiguous recording area of the information storage medium, or can be divided into smaller interleaved units, multiplexed, and recorded. Therefore, it is possible to easily track and reproduce motion picture data for multi-angle and also facilitate recording area arrangement when one clip is recorded in a contiguous storage area.

FIG. 1

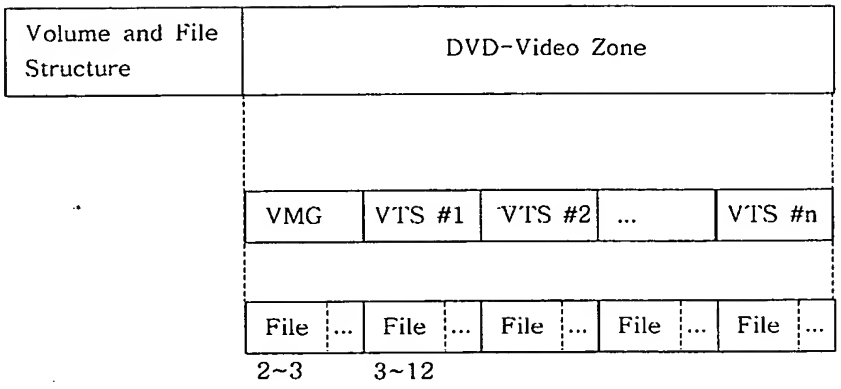
Volume and File Structure
DVD-Video Zone
VMG
VTS #1
VTS #2
...
VTS #n
File
...
File
...
File
...
File
...
File
...
2~3
3~12

FIG. 2

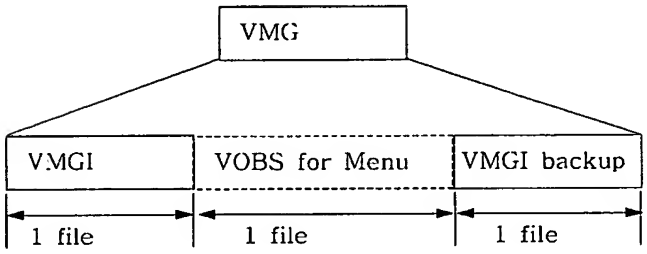
VMG
VMGI
VOBS for Menu
VMGI backup
1 file
1 file
1 file

FIG. 3

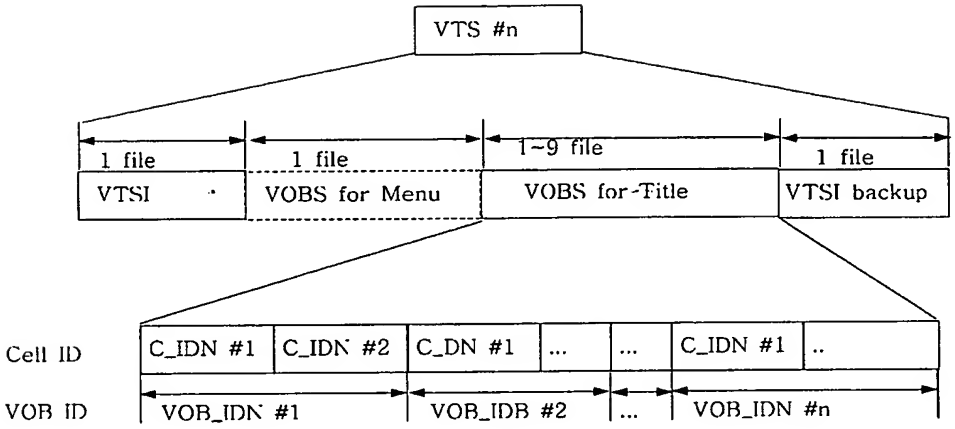

FIG. 4

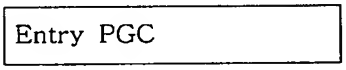

FIG. 5

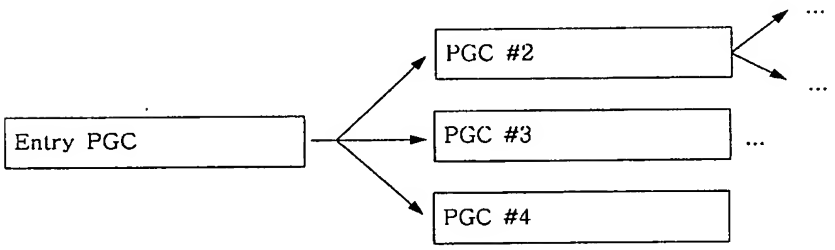

FIG. 6

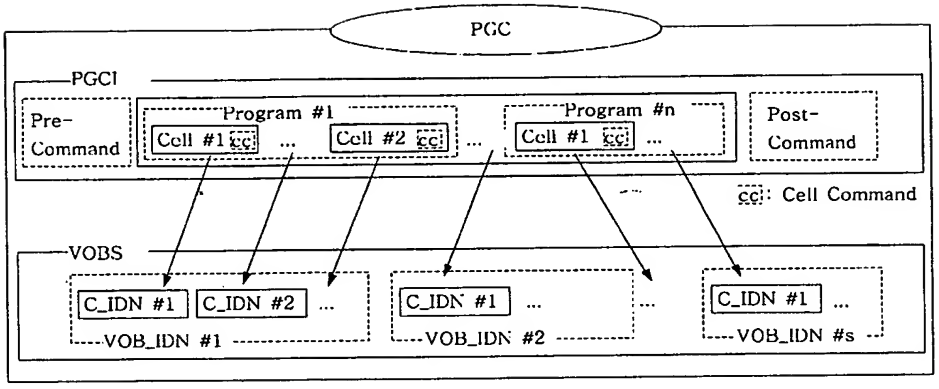

FIG. 7

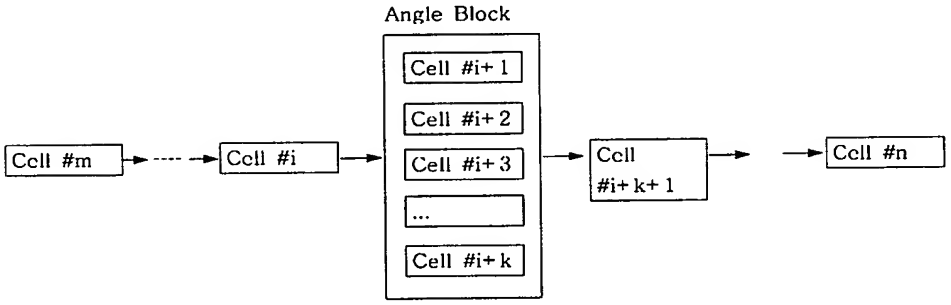

FIG. 8

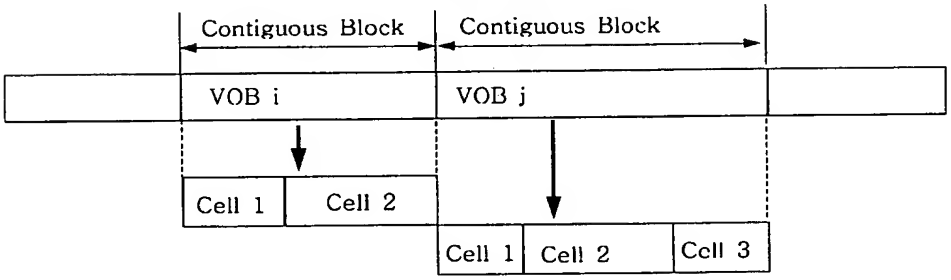

FIG. 9

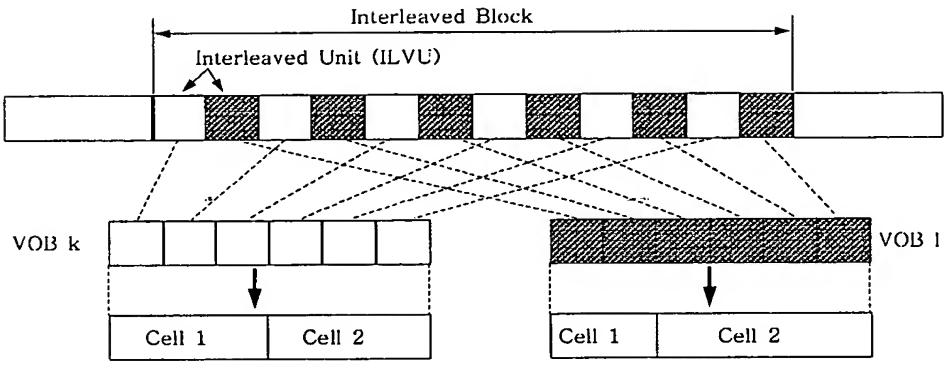

FIG. 10

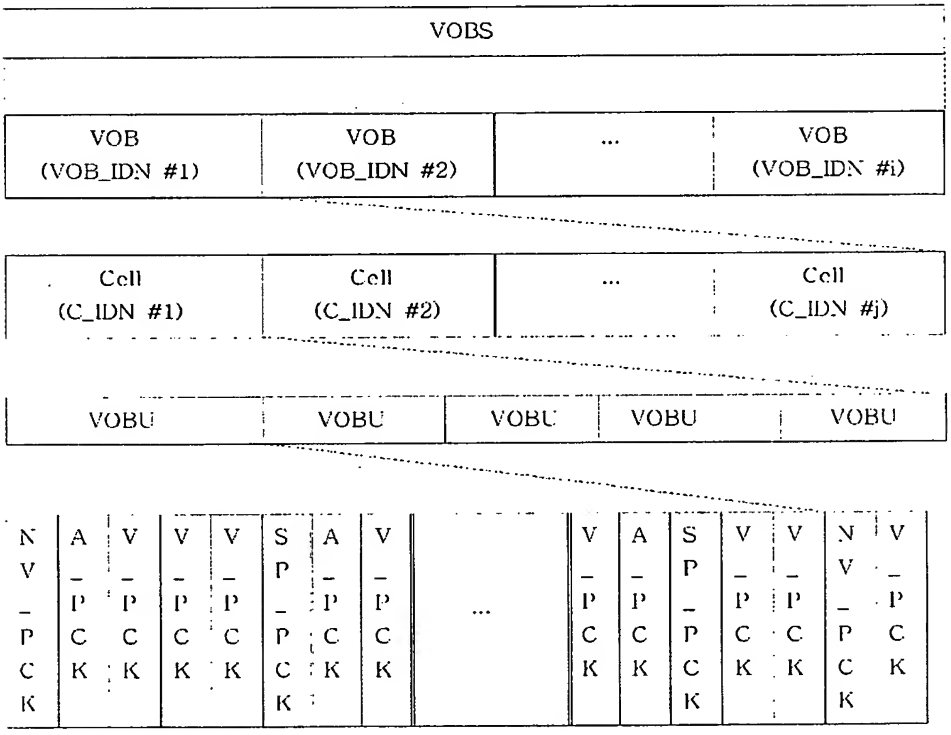

FIG. 11

SML_AGL_C1_DSTA(Address and size of destination ILVU in AGL_C1)
SML_AGL_C2_DSTA(Address and size of destination ILVU in AGL_C2)
SML_AGL_C3_DSTA(Address and size of destination ILVU in AGL_C3)
SML_AGL_C4_DSTA(Address and size of destination ILVU in AGL_C4)
SML_AGL_C5_DSTA(Address and size of destination ILVU in AGL_C5)
SML_AGL_C6_DSTA(Address and size of destination ILVU in AGL_C6)
SML_AGL_C7_DSTA(Address and size of destination ILVU in AGL_C7)
SML_AGL_C8_DSTA(Address and size of destination ILVU in AGL_C8)
SML_AGL_C9_DSTA(Address and size of destination ILVU in AGL_C9)

FIG. 12

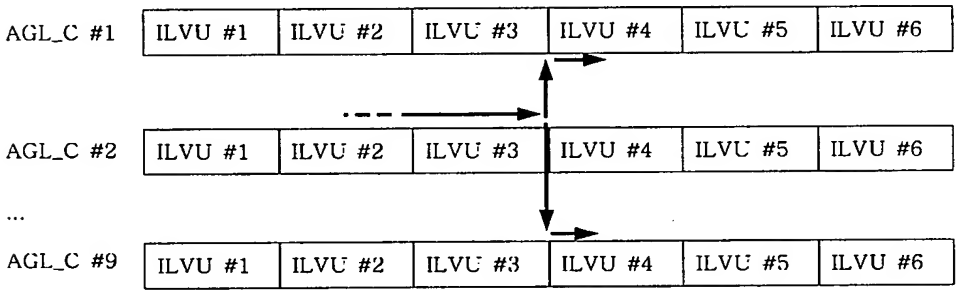

FIG. 13

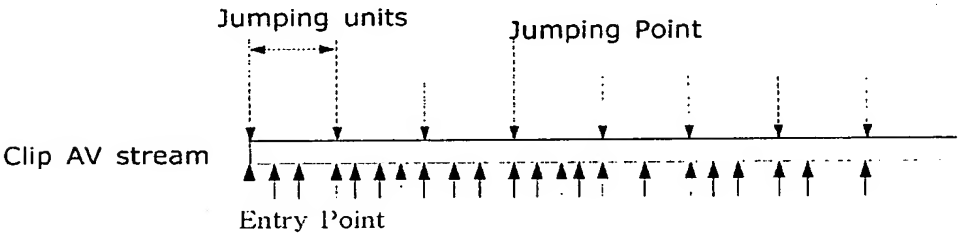

FIG. 14

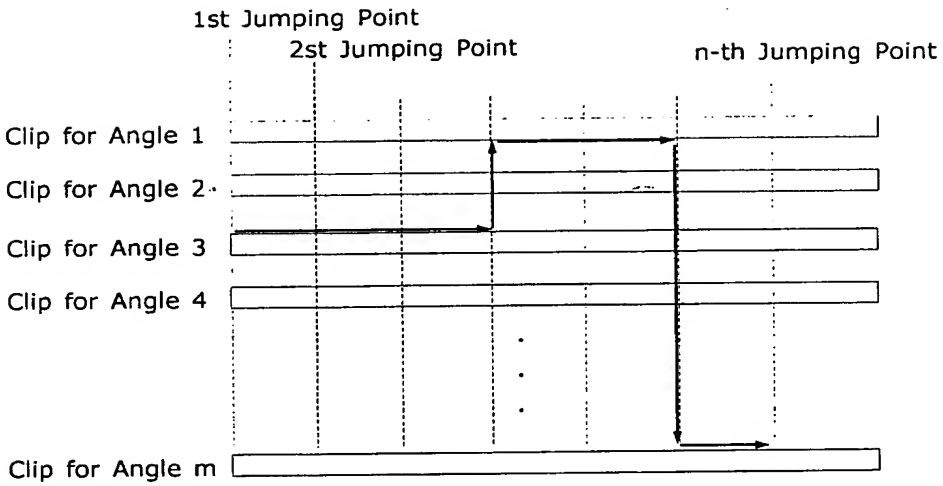
1st Jumping Point
2st Jumping Point
n-th Jumping Point
Clip for Angle 1
Clip for Angle 2
Clip for Angle 3
Clip for Angle 4
Clip for Angle m

FIG. 15

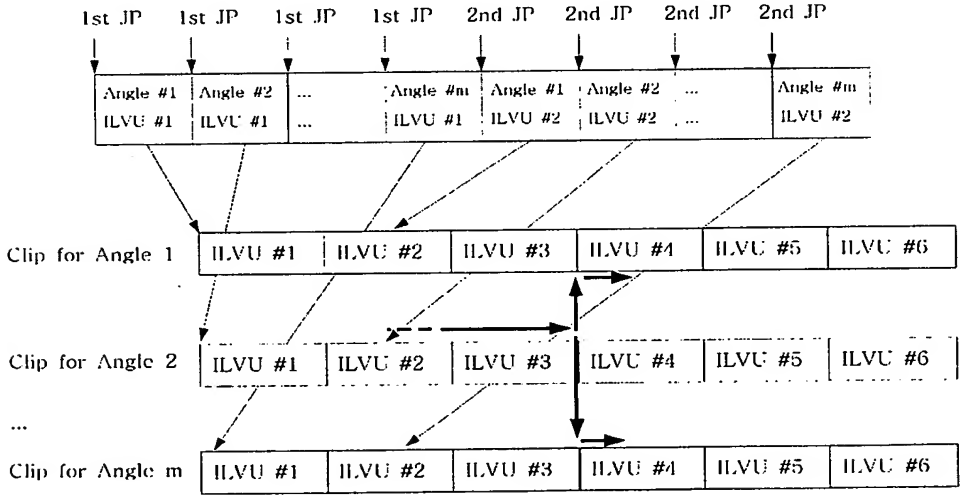
1st JP
1st JP
1st JP
1st JP
2nd JP
2nd JP
2nd JP
2nd JP
Angle #1 ILVU #1
Angle #2 ILVU #1
Angle #m ILVU #1
Angle #1 ILVU #2
Angle #2 ILVU #2
Angle #m ILVU #2
Clip for Angle 1
Clip for Angle 2
Clip for Angle m
ILVU #1
ILVU #2
ILVU #3
ILVU #4
ILVU #5
ILVU #6

FIG. 16

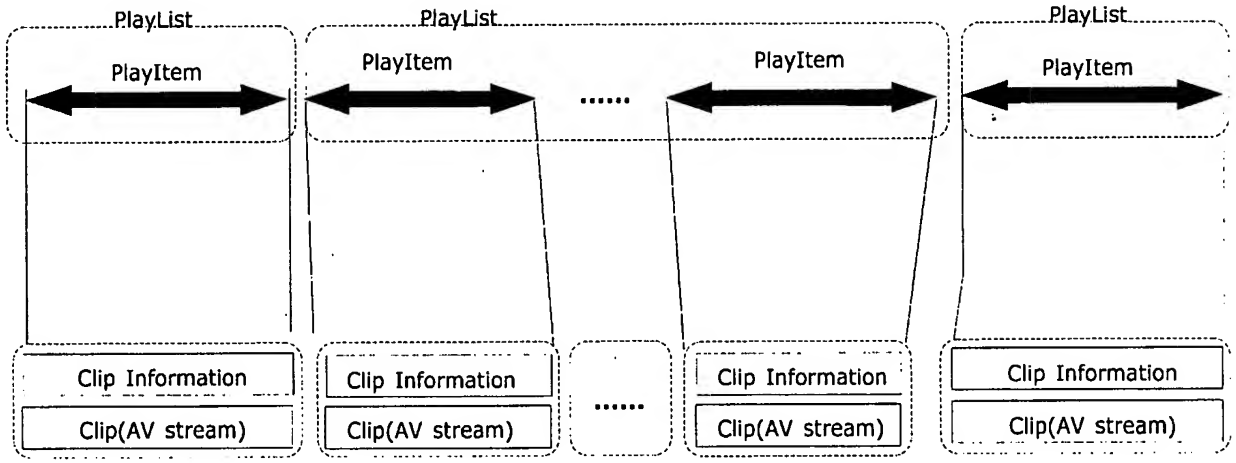
PlayList
PlayList
PlayList
PlayItem
PlayItem
PlayItem
PlayItem
.....
Clip Information
Clip(AV stream)
Clip Information
Clip(AV stream)
.....
Clip Information
Clip(AV stream)
Clip Information
Clip(AV stream)

FIG. 17

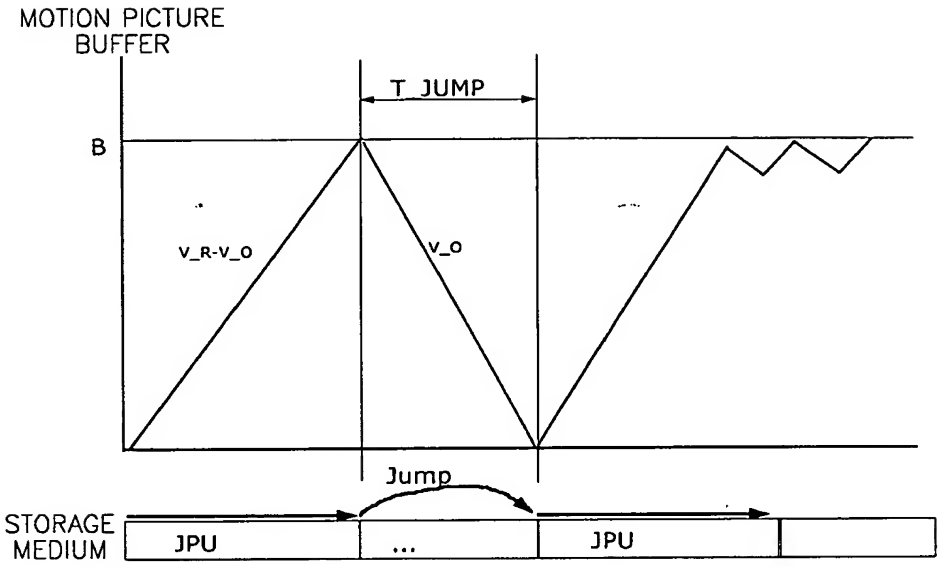

FIG. 18

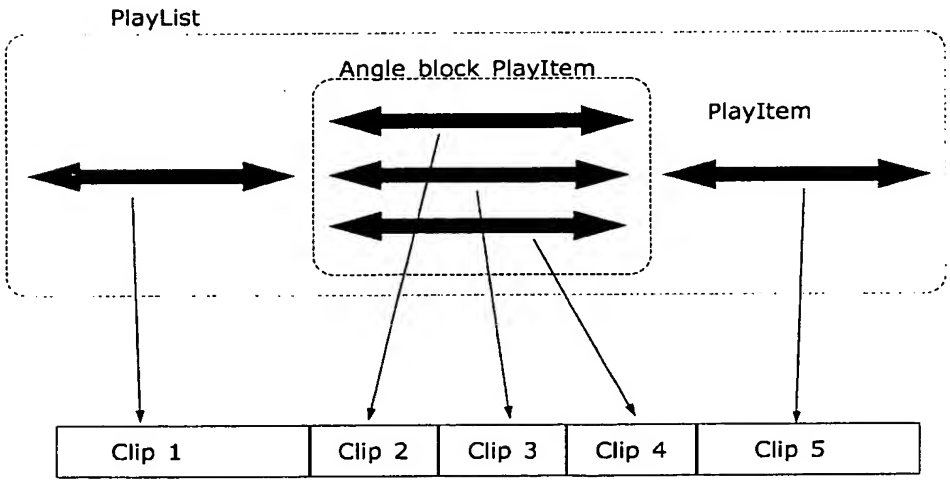

FIG. 19

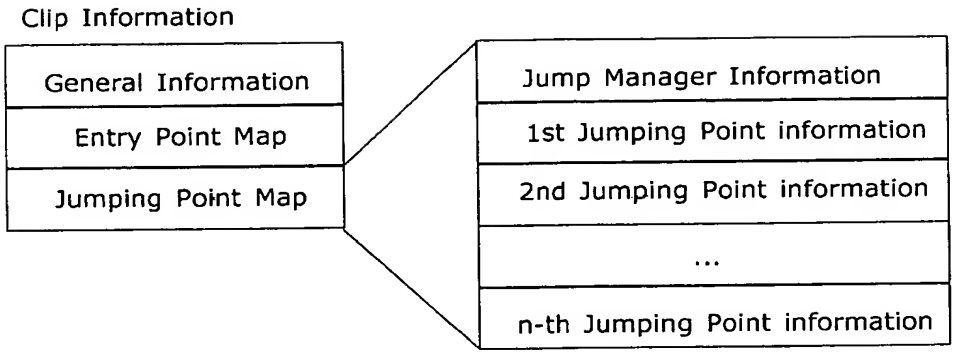
Clip Information
General Information
Entry Point Map
Jumping Point Map
Jump Manager Information
1st Jumping Point information
2nd Jumping Point information
...
n-th Jumping Point information

FIG. 20

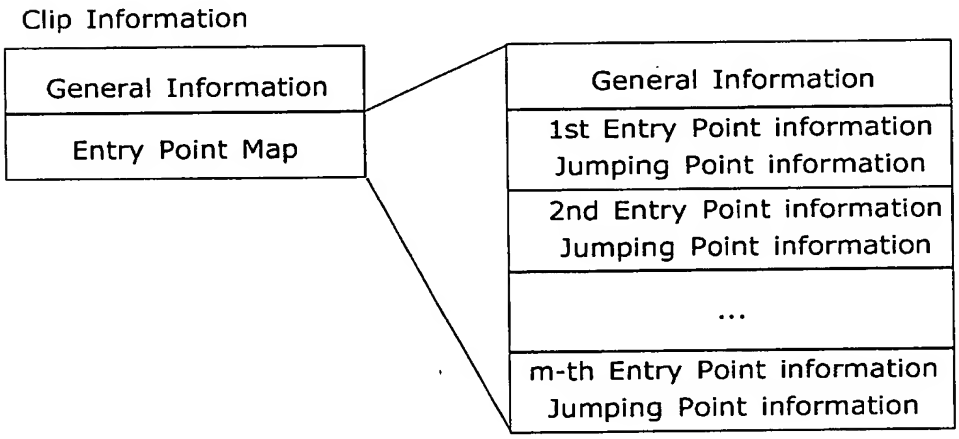
Clip Information
General Information
Entry Point Map
General Information
1st Entry Point information
Jumping Point information
2nd Entry Point information
Jumping Point information
...
m-th Entry Point information
Jumping Point information

FIG. 21

Jumping Point Map Information

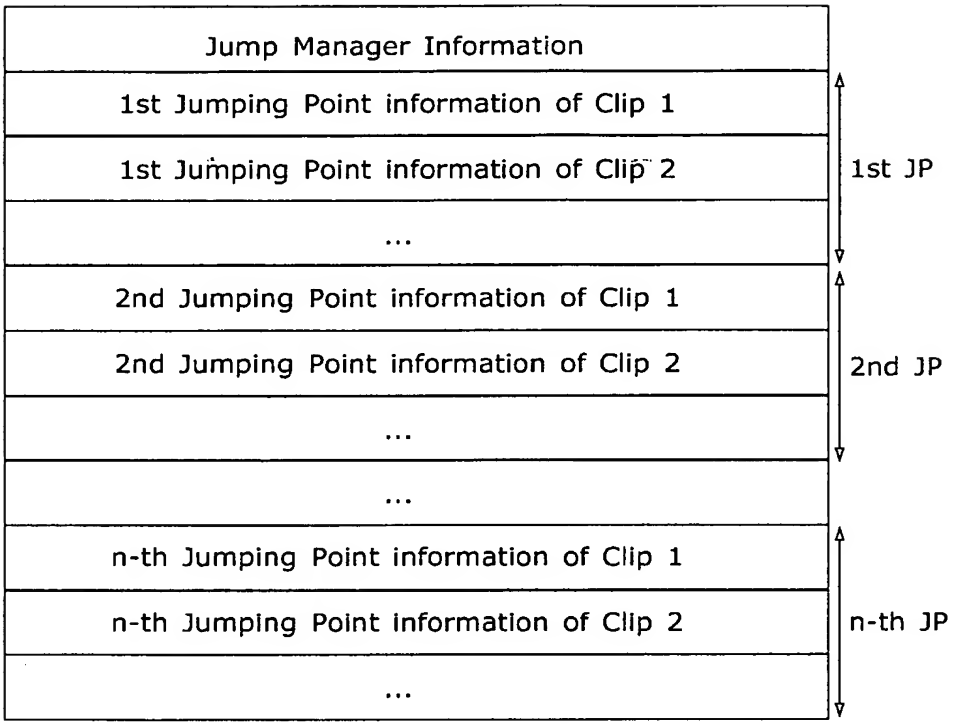

FIG. 22

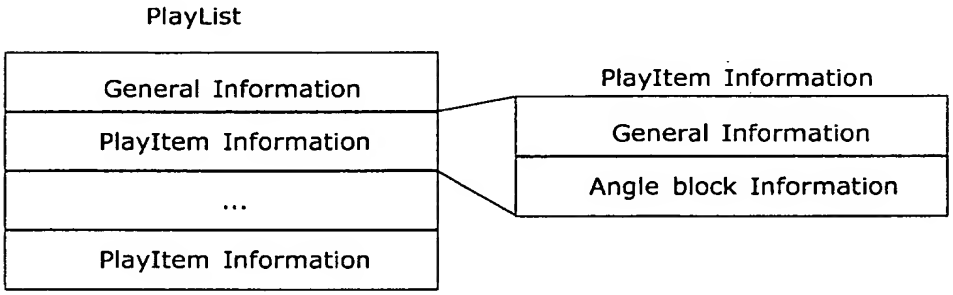

FIG. 23

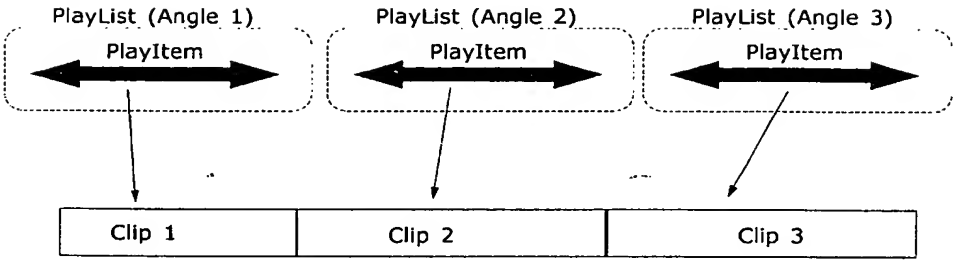

FIG. 24

PlayList

General Information
Angle block Information
PlayItem Information
...